CLAIMS

What is claimed is:

1. A thermally monitored power dissipating semiconductor device, comprising:

a power dissipating device structure operative to generate a temperature difference between a relatively cold peripheral area of the device and a relatively warm central area of the device, the temperature difference having a known relationship to electrical operating conditions of the device; and

a Seebeck effect thermoelectric sensor integrally formed with the device structure, the sensor having one or more warm junctions at the central area of the device and one or more cold junctions at the peripheral area of the device, the sensor being operative to generate an electrical output signal having a known relationship to the temperature difference between the peripheral and central areas of the device so as to provide an indication of the electrical operating conditions of the device.

2. A semiconductor device according to claim 1, wherein the power dissipating device structure comprises a power MOSFET.

3. A semiconductor device according to claim 1, wherein the power dissipating device structure comprises source and drain diffusions of a power MOSFET, and wherein the hot and cold junctions of the sensor are formed by respective traces of polysilicon and metal disposed over the source and drain diffusions.

4. A semiconductor device according to claim 1 having multiple warm junctions and a corresponding number of cold junctions to form a number of warm-cold junction pairs, the junction pairs being connected in series such that the thermal-to-electrical gain

ATTORNEY DOCKET NO. UNITI-15XX
WEINGARTEN, SCHURGIN,
GAGNEBIN & LEBOVICI LLP
TEL. (617) 542-2290
FAX. (617) 451-0313

of the Seebeck sensor is substantially proportional to the number of such pairs.

5. A semiconductor device according to claim 1, wherein the sensor has a geometric arrangement effective to cancel the effect of background thermal gradients on the substrate.

6. A circuit, comprising:

a power dissipating device arranged between a source and a load, the device being operative to generate a temperature difference between a relatively cold peripheral area of the device and a relatively warm central area of the device, the temperature difference having a known relationship to electrical operating conditions of the device;

a Seebeck effect thermoelectric sensor integrally formed with the device, the sensor having one or more warm junctions at the central area of the device and one or more cold junctions at the peripheral area of the device, the sensor being operative to generate an electrical output signal having a known relationship to the temperature difference between the peripheral and central areas of the device so as to provide an indication of the electrical operating conditions of the device; and

circuitry operative in response to the electrical output signal of the sensor to modify the operation of the circuit in a corresponding predetermined fashion.

7. A circuit according to claim 6, wherein the temperature difference from which the sensor generates the electrical output signal is substantially independent of an average temperature common to both the warm and cold junctions, and wherein the electrical output signal is used by the operation-modifying circuitry without any qualification as to absolute temperature.

ATTORNEY DOCKET NO. UNITI-156XX
WEINGARTEN, SCHURGIN,
GAGNEBIN & LEBOVICI LLP
TEL. (617) 542-2290
FAX. (617) 451-0313

8. A circuit according to claim 6, further comprising additional temperature sensing circuitry operative to provide an indication of an absolute temperature in a region near the power dissipating device, and wherein the operation-modifying circuitry is operative to qualify the electrical output signal from the sensor with the indication from the additional temperature sensing circuitry.

9. A circuit according to claim 8, wherein the qualification of the sensor output signal by the operation-modifying circuitry includes the logical OR-ing of the sensor output signal with the indication from the additional temperature sensing circuitry.

10. A circuit according to claim 8, wherein the qualification of the sensor output signal by the operation-modifying circuitry includes (1) comparing the sensor output signal with a variable threshold value, and (2) decreasing the threshold value as the temperature in the region near the device increases as indicated by the additional temperature sensing circuitry.

11. A circuit according to claim 6, wherein the power dissipating device is a power MOSFET.

12. A circuit according to claim 6, wherein the operation-modifying circuitry is thermal protection circuitry operative to effect a shutdown of the power-dissipating device when the electrical output signal from the sensor indicates that the power dissipation of the power-dissipating device is approaching a predetermined acceptable maximum value.

ATTORNEY DOCKET NO. UNITI-156XX
WEINGARTEN, SCHURGIN,
GAGNEBIN & LEBOVICI LLP
TEL. (617) 542-2290
FAX. (617) 451-0313